Radiance Temperatures and Normal Spectral Emittances (in the Wavelength Range of 1500 nm to 5000 nm) of Tin, Zinc, Aluminum, and Silver at their Melting Points by a Pulse-Heating Technique

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The radiance temperatures (at four wavelengths in the range of 1500 nm to 5000 nm) of tin, zinc, aluminum, and silver at their respective melting points were measured by a pulse-heating technique using a high-speed fiber-coupled four-wavelength infrared pyrometer. The method is based on rapid resistive self-heating of a specimen from room temperature to its melting point in less than 1 s while measuring the radiance emitted by it in four wavelength bands as a function of time. A plateau in the recorded radiance-versus-time traces indicates melting of the specimen. The melting-point radiance temperatures for a given specimen are determined by averaging the measured temperatures along the plateau at each wavelength. The melting-point radiance temperatures for each metal are, in turn, determined by averaging results for several specimens. The normal spectral emittances at the melting transition of each metal are derived from the measured radiance temperatures at each wavelength and the published values of the thermodynamic (true) melting temperatures. Cezairliyan, Righini and collaborators [1] have suggested that the melting-point radiance temperatures (near 0.65 µm and 1 µm) of selected high-melting metals may be used as secondary reference points for pyrometry. We discuss the possibility of using the radiance temperatures at the melting points of tin, zinc, aluminum, and silver in a similar manner for infrared pyrometry.

[1] T.A. Cezairliyan, A.P. Miiller, F. Righini, and A. Rosso, in Temperature: Its Measurement and Control in Science and Industry, Vol. 5, p. 377, edited by J.F. Schooley, AIP 1992